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The genus *Coleia* Broderip, 1835 (Crustacea, Decapoda) in the Sinemurian of Osteno in Lombardy

Abstract — A new sample of more than 60 eryonoid decapod crustaceans from the Sinemurian of Osteno (Como) is examined. All the specimens are attributed to the genus *Coleia* Broderip, 1835, of which two new species are described: *C. pinnai* n. sp. and *C. popeyei* n. sp.. Two other species from the same deposit, *C. mediterranea* Pinna, 1968 and *C. viallii* Pinna, 1968 are discussed. Some palaeoecological observations on the palaeofauna of Osteno are also furnished.

Riassunto — Il genere *Coleia* Broderip, 1835 (Crustacea, Decapoda) del Sinemuriano di Osteno (Lombardia). Nel presente lavoro viene esaminato un nuovo campione di crostacei decapodi erionidei provenienti dal giacimento sinemuriano di Osteno (Como). Tutti gli esemplari vengono attribuiti al genere *Coleia* Broderip, 1835, del quale vengono descritte due nuove specie: *C. pinnai* n. sp. e *C. popeyei* n. sp.. Vengono inoltre fornite ulteriori osservazioni su due specie già note in precedenza nello stesso giacimento, *C. viallii* Pinna, 1968 e *C. mediterranea* Pinna, 1968. Il lavoro termina con una breve nota di osservazioni paleoecologiche sul giacimento di Osteno.

Key words: Crustacea, Decapoda, Jurassic, Italy.

Introduction

Eryonoid decapod crustaceans of the genus *Coleia* Broderip, 1835 have been the first fossils of the Sinemurian deposit of Osteno (on the north eastern bank of Lugano Lake, Como province) to be described in two successive papers by Pinna in 1968 and 1969. In the first and more exhaustive of these

(*) Museo Civico di Storia Naturale di Milano.

two works, Pinna described seven specimens referred to two new species, *C. viallii* and *C. mediterranea*, one specimen attributed to *Coleia* cfr. *antiqua* Broderip, 1835, and one specimen — reported as *Coleia* (?) n. sp. (?) — very difficult to assign to a species if not to the genus. In the second work, Pinna described other two specimens of *Coleia viallii* Pinna, 1968, which made possible a complete reconstruction of the species in dorsal view.

After more than fifteen years, the collection of fossils from Osteno of the Museo Civico di Storia Naturale di Milano has become considerably richer, thanks to private donations of materials as well as to the excavations that the Museum itself has been carrying out in last years in the Osteno deposit after the old quarries have been closed. In particular the collection includes more than sixty new specimens of eryonoid decapods that can be assigned to the genus *Coleia* Broderip, 1835. The majority of such specimens belongs to the species *C. viallii* Pinna, 1968, already described thoroughly by the author; the remaining specimens, that account for about 20 percent of the eryonoid decapods contained in the deposit, belong instead to species that are already known but not fully described because of the inadequate state of preservation of original specimens, as in the case of *C. mediterranea* Pinna, 1968, or belong to completely new specific entites.

Part of this work was one of the arguments of the thesis of dr. Manuëla Novati at the University of Genoa, with which I am very indebted.

Hereafter I give a comprehensive description of all new specific entities and of those already known, whose knowledge can be widened thanks to the new specimens.

As regards a general introduction to the systematics of the eryonoids in general and of the genus *Coleia* in particular, I refer to the exhaustive treatment of the topic in the first part of the work by Pinna, 1968.

Order Decapoda Latreille, 1803
 Infraorder Palinura Latreille, 1803
 Superfamily Eryonoidea De Haan, 1841
 Family Coleiidae Van Straelen, 1924
 Genus *Coleia* Broderip, 1835

Coleia pinnai n. sp.
 Figs. 1, 2, 3, 4, 5, 6

Derivatio nominis: dedicated to Prof. G. Pinna, the first who described the eryonid crustaceans of the Osteno deposit.

Holotype: n. cat. MSNM/i 6111, Collection of the Museo Civico di Storia Naturale di Milano.

Paratypes: N. cat. MSNM/i 7659; i 7747.

Locus typicus: Osteno (Como, Italy).

Geological age: Lower Sinemurian, "bucklandi zone".

Diagnosis: large sized decapod crustacean, dorsoventrally flattened. Carapace subrectangular; scaphocerite petaloid, distally pointed. First pair of pereopods much elongated and thin, with a 2.3 ratio of propodus/carpus length. Chelae with distally bent dactylus, longer than the index. Cephalic

groove with anteroconcave pattern. Less evident branchial groove, with the same pattern than the cephalic one. Well marked longitudinal dorsal ridge with two less pronounced lateral ridges on the carapace. Abdominal pleurae rounded. Triangular, distally rounded telson. Exopods of uropods with diaeresis.

Material. Four specimens are assigned to the new species. Two of them are complete with their counterpart (n. cat. MSNM/i6111, i7659) and two with only the part (n. cat. MSNM/i7661, i7657); I ascribe to the new species also two single isolated pereiopods of the first pair (n. cat. MSNM/i7747, i7748).

Description. The carapace is subrectangular, dorsoventrally flattened; it reaches its maximum width in correspondence of the branchial incisions, and tapers posteriorly. Laterally it features two well marked incisions, cervical and branchial, corresponding to the attendant grooves.

The anterior margin is almost rectilinear, with two thin median spines and scarcely pronounced ocular incisions. On the outer edges there are two narrow and forward elongated suprantennal spines.

The cervical groove is very little evident and quite widely V-shaped, with the concavity frontward directed. The branchial groove shows a similar pattern, with a slightly curved appearance; it is even less pronounced than the cervical groove.

A median longitudinal ridge begins just before the cervical groove and stretches to the back margins of the carapace itself. There are also two lateral ridges running from the cervical groove to the posterior margin. They converge slightly in the median ridge near the cervical groove, whereas they keep a parallel pattern in the posterior region of the carapace. The posterior margin of the carapace is slightly bent forward.

The carapace surface is ornamented with strong tubercles of circular section and rather consistent size. Along the lateral margins there is a row of short, forward bent spines of roughly triangular form, developed especially in the anterior half of the lateral margins.

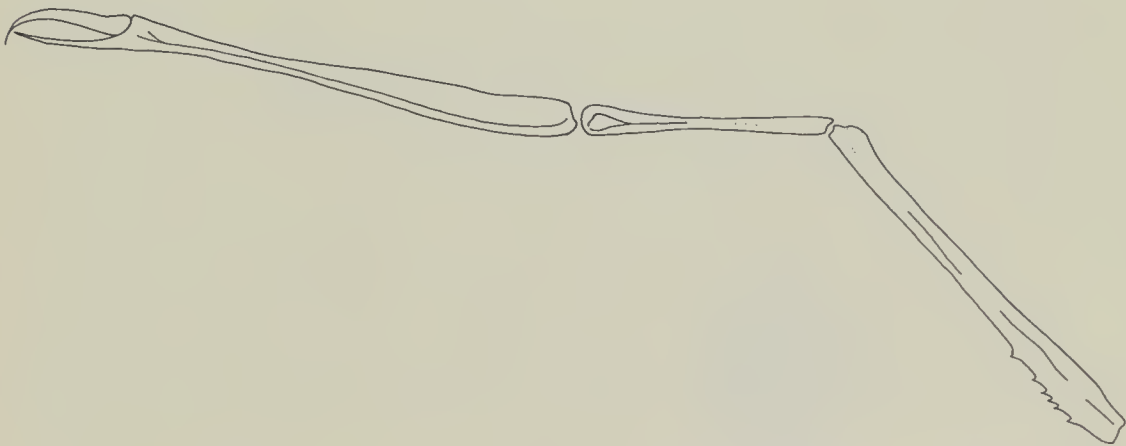


Fig. 1 — *Coleia pinnai* n. sp. . line drawing of spec. MSNM/i7747, consisting of an isolated first pereiopod. $\times 1,1$.

The antennae and antennules have bases slightly ornamented with tubercles, like the basicerite and scaphocerite. The latter is petaloid and pointed at the distal extremity with marginal, forward bent spines of subtriangular form, and is crossed by an almost median longitudinal carina. Eyes are roundish, well developed, in anterolateral position (fig. 2).

The first pair of pereiopods (fig. 1) looks rather unusual if compared with that of one other species of the genus *Coleia*. In fact it has a considerable development in length and it is relatively slim, with elongated and thin merus; this is slightly curved, with spines along the inner margins and is ornamented with tubercles. The much elongated and thin carpus has no ornamentation at all. Also the propodus is slim; it has no lateral spines whereas it features a tubercular ornamentation. Dactylus and index show an initial subparallel pattern, while distally the dactylus — which is longer — folds clearly on the index. Merus, carpus and propodus have a faint longitudinal carina. The remaining pairs, all chelated except pereiopods V, are definitely less developed than the first pair.

The abdomen is well preserved only on the holotype (fig. 5). It is wider anteriorly and tapers considerably backwards. Its total length — telson and uropods not included — is about 75% of that of the carapace. All the tergites show a median, longitudinal rostrated carina. The rounded pleurae are ornamented with large tubercles, as well as the tergites. Uropods are well developed and distally rounded, with exopods featuring a crescent diaeresis and exopods strengthened by a median longitudinal carina.

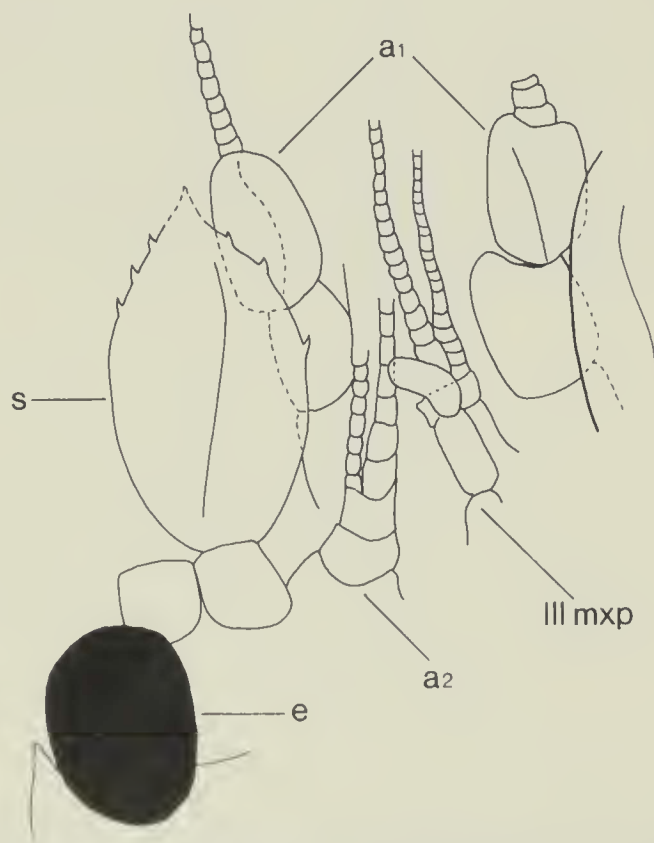


Fig. 2 — *Coleia pinnai* n. sp. . Cephalic appendages of the holotype (n. cat. MSNM/i6111). $\times 5$. a₁: antennae; a₂: antennulae; e: eye; III mxp: third massilliped; s: scaphocerite.

Observations and comparisons. On the basis of the carapace and abdomen morphology as well as of the presence of a diaeresis on uropod exopods, the new species can be clearly assigned to the genus *Coleia* Broderip, 1835. However, it differentiates at first sight from the other known species of the same genus because of the typical first pair of pereopods, that shows a much more elongated carpus in comparison with the merus than in any other form of *Coleia*.

In addition, the pereopods of the first pair are rather unusual since, as a whole, they are relatively thin and much elongated in comparison with the body length of the animal, recalling those of the living erylid *Polycheles*.

As far as a comparison with the other species of the Osteno deposit is concerned, in *C. viallii* the first pair of pereopods has a total length which is proportionally smaller than body length, and also the pereopods themselves are much stronger. The carpus is thin and much elongated in the new species, whereas it is short, stumpy and subtriangular in *C. viallii*, which also has more robust index and dactylus. These have an identical length and are practically rectilinear. The shape of the carapace is a further element of differentiation, since in *C. pinnai* it is much longer than wider. Such a morphology cannot be found in *C. viallii*, that furthermore shows some variability in the shape of the cephalothorax. Then, in the new species the cervical and branchial grooves are not very evident, whereas in *C. viallii* they are well pronounced; the carapace of *C. viallii* does not feature lateral marginal spines. As regards cephalic appendages, the two forms differ in the shape of the scafo-cerite, that in *C. viallii* is much more rounded at the distal extremity and without lateral spines; in

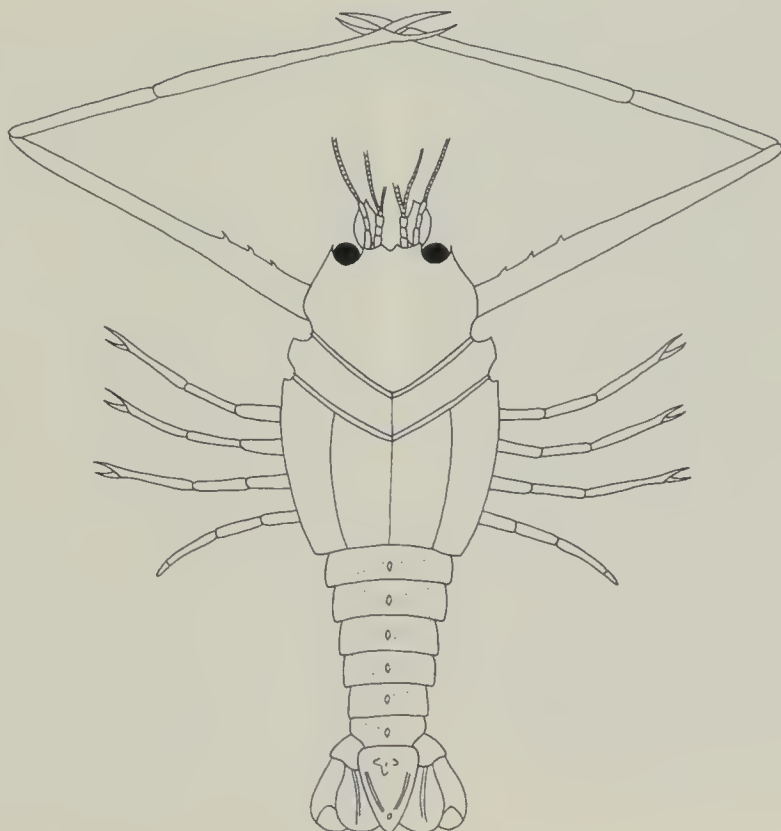


Fig. 3 — *Coleia pinnai* n. sp.; reconstruction, $\times 0,5$.

the two species the eye position is different: eyes are more central in *C. viallii* and more lateral in *C. pinnai*. A further difference between these two forms is to be found in the shape of uropods. In the new species, exopod and endopod are spatular and not as roundish as in *C. viallii*. The pattern of the exopod diarsis is also different.

The new species can be distinguished easily also from *C. mediterranea* Pinna, 1968. In the latter, the carapace has a subquadrangular form and shows distinct cervical and branchial grooves, while the two lateral carinas typical of *C. pinnai* are missing. In *C. mediterranea*, the cephalothorax posterior margin is wide and slightly rounded at the edges, while it is narrower, more markedly concave and with more pointed lateral edges in the new species. The scafoce-rite, which is petaloid and pointed in *C. pinnai*, is instead oval in *C. mediterranea*. In the two species the pereopods of the first pair are longer than the animal body, but in *C. mediterranea* the carpus is definitely less developed than the propodus, the merus is slightly bent and not rectilinear as in the new species. The propodus — that looks long and narrow in both forms — is however different, since in *C. mediterranea* it has equally long index and dactylus; these are slightly curved at the distal extremity. The abdomen of these two species differs in the size of somites, that are wider and proportionally shorter in the

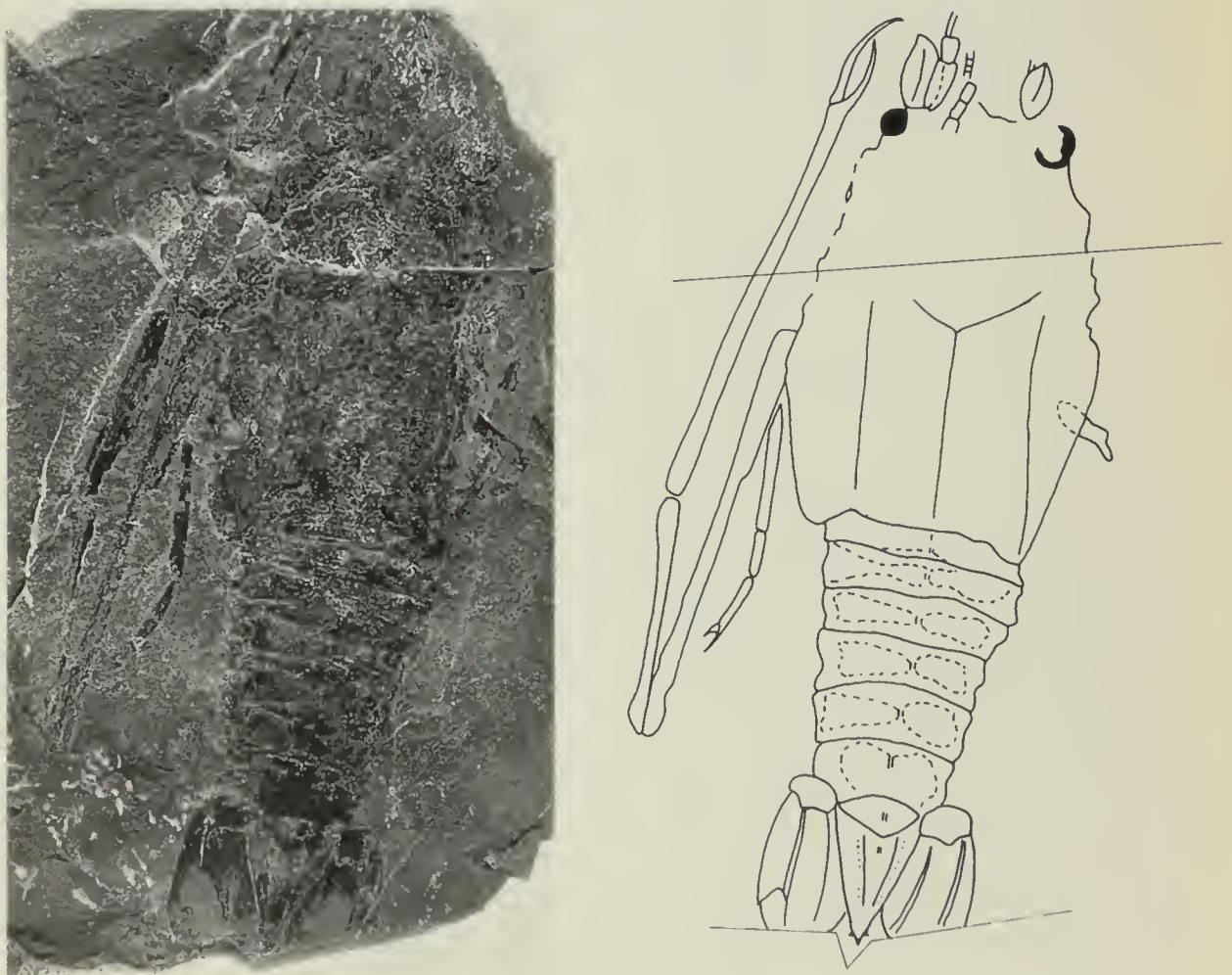


Fig. 4 — *Coleia pinnai* n. sp., Paratype, part (n. cat. MSNM/i7659a) with reconstruction; $\times 1$.

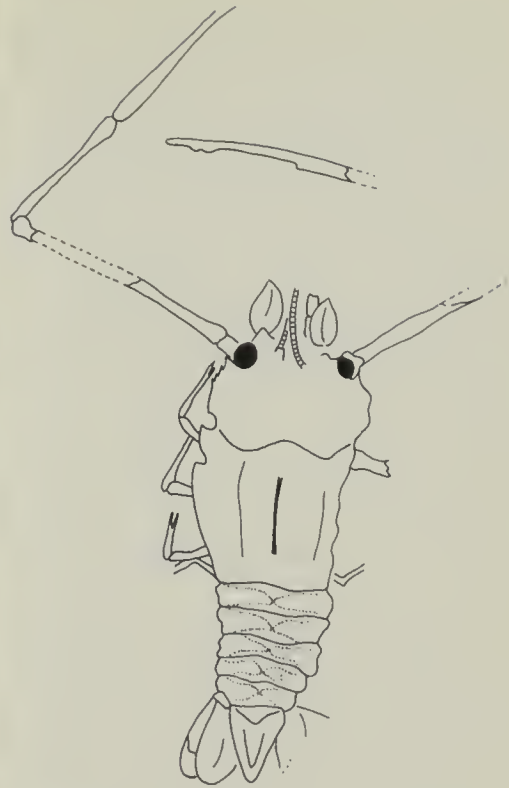


Fig. 5 — *Coleia pinnai* n. sp.. Holotype, part (n. cat. MSNM/i6111a) with reconstruction; $\times 0,6$.

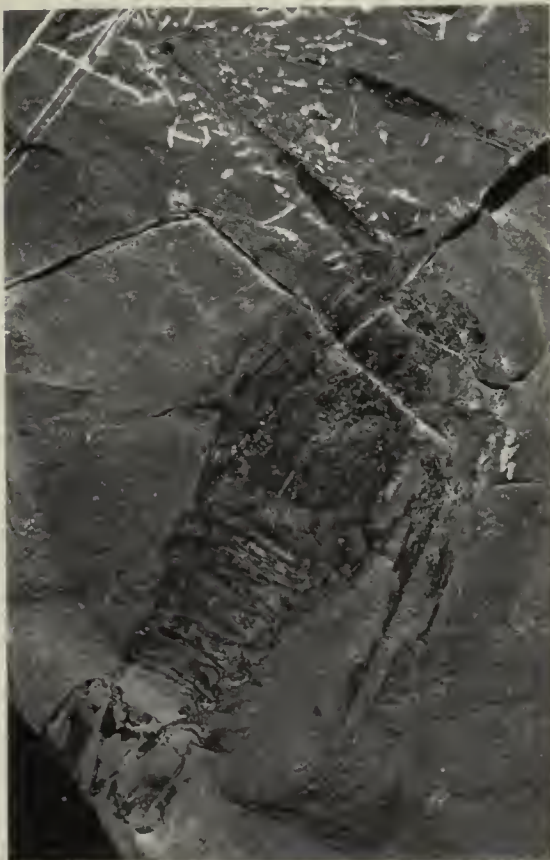


Fig. 6 — *Coleia pinnai* n. sp.. Paratype, counterpart (n. cat. MSNM/i7659b) with reconstruction; $\times 0,7$.

new species. The telson is distally pointed in both forms, but it has a larger base in *C. mediterranea*.

In comparison with *C. antiqua* Broderip, 1835 from the Lower Sinemurian of Lyme Regis, *C. pinnai* differs considerably in several morphological details, first and foremost the limited development of the carpus of the first pair of pereopods in *C. antiqua*. Furthermore, in the latter species the carapace — even if subrectangular in shape — is proportionally less elongated and with more rounded lateral margins. Then, the scafoerite of the said English species is roundish and not as pointed as in the new species.

On the basis of these differences with similar species, I justify the separation of the new form into a new specific entity.

Coleia popeyei n. sp.

Figs. 7, 8, 9, 10

1968 *Coleia* (?) n. sp. (?) - Pinna p. 108, Fig. 4; Pl. III, figs. 2,3.

Derivatio nominis: dedicated to Popeye, a character of the cartoonist E. C. Segar. We have always called "Braccio di ferro" (the italian name of Popeye) specimens of this species because of the strong propodus, recalling Popeye's arm muscles.

Holotype: N. cat. MSNM/i7683 a, b,; i7684; i7688.

Locus typicus: Osteno (Como, Italy).

Geological age: Lower Sinemurian, "bucklandi zone".

Diagnosis. Small-size decapod crustacean, with flattened cephalothorax and abdomen. First pair of pereopods with strong, swollen propodus and outer dactylus. Anterior margin of carapace with two small ocular incisions in median position, separated by a wider incision. Carapace with anteroconvex posterior margin; this is not wide and is rounded near the lateral margins. Carapace dorsal surface crossed by a scarcely pronounced dorsal groove, the groove having a wide-V pattern with forward concavity. Median longitudinal carina running from the anterior to the posterior margin of the carapace. Light ornamentation with tubercles.

Abdominal tergites with a median longitudinal carina, provided with a retroverted spine. Rounded pleurae. Tergites showing a light tubercular ornamentation. Elongated triangular telson, with margins proximally recurved and two lateral carinae converging distally. Exopods of uropodites with diaeresis.

Material. We have available eight specimens, mostly complete with their counterpart (n. cat. MSNM/i3369, i7683, i7684, i7686, i7687, i7688, i7780). They are mostly small specimens, usually less than 30 mm in length, with the exception of the holotype (figured by Pinna, 1968, T. III, figs. 2, 3), whose total length is of 34 mm.

Description. The markedly roundish carapace has a slightly anteroconvex posterior margin and a frontal margin with rounded outline. The lateral margins look swollen and are provided with weak proverted spines.

In contrast with the other bigger species of *Coleia* found in the Osteno deposit, the anterior margin of the carapace is difficult to observe on all specimens due to the poor state of preservation in such small and poorly mineralized exoskeletons. It is possible to identify two small ocular incisions in the centre, that are separated by a wide, not very deep intraocular incision, delimited by a small lateral spine (suprantennal spine). In some specimens eyes are still preserved; they are supported by a wide orbit and are small in size if compared with the body.

In some more sclerotized specimens it is possible to observe a carapace ornamentation consisting of tubercles of varying thickness; on the dorsal surface of the carapace itself there is a rectilinear median carina, which courses all the carapace longitudinally. There are also two lateral carinas beside the median one; they run parallel in the carapace posterior region and converge slightly in the anterior half. In all specimens is clearly visible an opened-V cervical groove on the carapace, with which two small incisions coincide on lateral margins. Only in two specimens I can recognize a possible second groove, that should correspond to the branchial groove.

Nothing is sure as regards cephalic appendages, since their state of preservation is very poor. Instead thoracic appendages are better preserved, in particular the first pair of pereopods, which is rather evident. It shows a rather elongated merus, whose length is like the sum of carpus and propodus (index excluded). The merus is approximately as long as the carpus, or slightly shorter. The carpus is triangular and definitely stumpy. The propodus is very wide and the dactylus is as long as the index. Dactylus and index show thin and

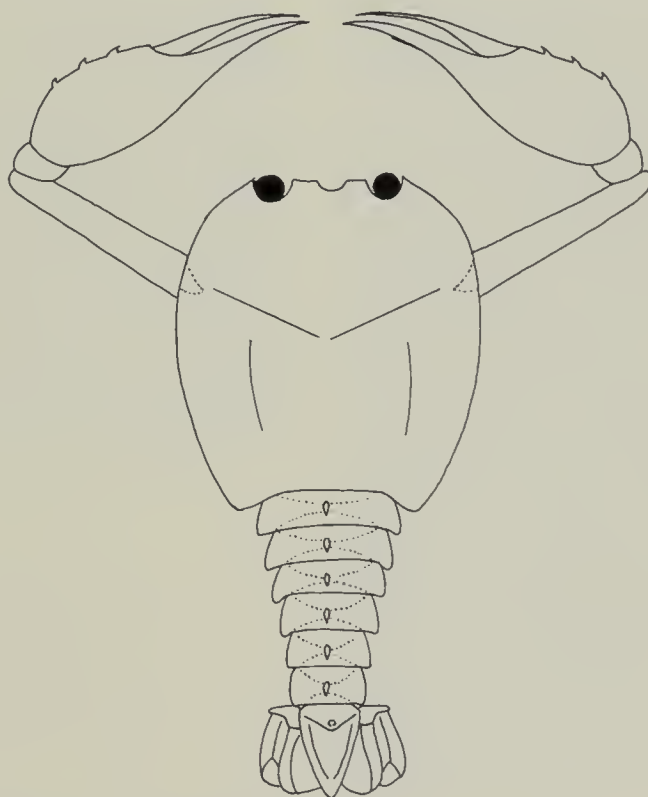


Fig. 7 — *Coleia popeyei* n. sp.; reconstruction, $\times 2$.

slightly curved distal extremities. The ornamentation of the first pair of pereopods consists of a carina along the merus internal margin. Some specimens also feature a simple merus ornamentation with very small tubercles and small proverted spines along the merus margin. In general, the carpus does not show any ornamentation at all, or, when present, it is very weak.

The abdomen is shorter than the cephalothorax; the tergites of the first five abdominal somites feature a median longitudinal carina provided with a retroverted rostrum, while on the last abdominal somite the carina has no rostrum. In addition, tergites show a rather evident tubercular ornamentation. The same type of ornamentation, though less pronounced, is found also on the rounded pleurae.

The triangular, distally pointed telson has lateral margins getting round proximally. The telson also features two tuberculated, lateral carinae. Along the telson lateral margins there are some retroversed denticles.

The uropod exopod has a bowed diaeresis; exopod and endopod are roundish and both are strengthened longitudinally by a longitudinal carina on their external third. In addition, their edges are ornated with short hairs. The uropod surface shows a scarcely pronounced tubercular ornamentation and margins have weak fimbriae.

Observations and discussion. The new species differs from *C. antiqua* Broderip, 1835 in the shape of the carapace, in the narrower telson and in the considerably rounded uropods.

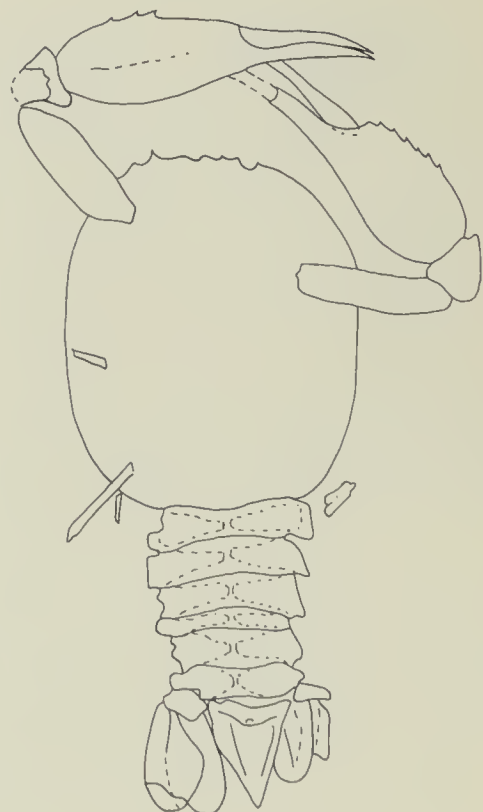
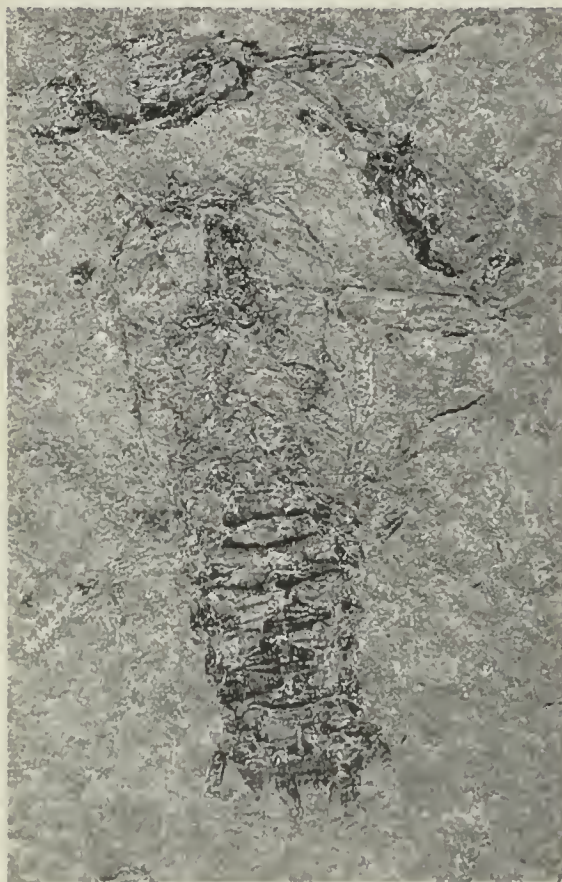


Fig. 8 – *Coleia popeyei* n. sp.. Paratype, counterpart (n. cat. MSNM/i7683b) with reconstruction; $\times 3.7$.

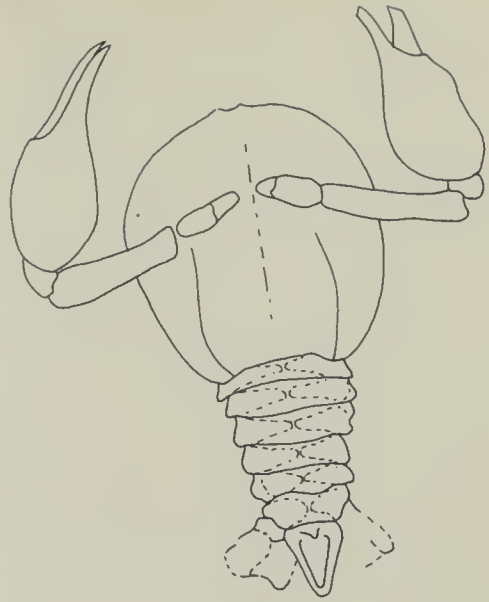


Fig. 9 — *Coleia popeyei* n. sp.. Paratype (n. cat. MSNM/i7684) with reconstruction; $\times 3,4$.



Fig. 10 — *Coleia popeyei* n. sp.. Paratype (n. cat. MSNM/i7688) with reconstruction; $\times 4$.

In the new species also the first pair of pereiopods is very different, since the propodus is quite large and the carpus and merus are shorter in comparison with the total length of the pereiopod; the pereiopod is also less developed with respect to the animal total length. The new species also differs from *C. barrovensis* (Mc Coy, 1849) in the narrower cephalothorax, in the absence of spines on lateral margins and in the longer uropods.

C. popeyei differs from *C. crassichelis* (Woodward, 1866) — that is the species most similar to it — in the cephalothorax, which is not as wide posteriorly — and in the absence of spines on its posterior margin. The first pair of

pereiopods is similar in the two species, though in *C. crassichelis* the merus is less long and considerably wider; also the shape of cervical incisions is similar in these two species.

C. popeyei is different from *C. tenuichelis* Woods, 1925 in the shape of cephalothorax, in the stronger first pereiopods and in the narrower abdomen. From *C. brodiei* it differs in the almost oval form of the carapace, in the less deep cervical incision and in the carapace anterior margin, characterized by rounded sides.

In 1968 Pinna described a specimen of eryonid and assigned it doubtfully to the genus *Coleia* (*Coleia* (?) n. sp. (?), cf. Pinna, 1968, p. 108). As it was a single specimen in a very poor state of preservation, the author referred it to the genus *Coleia* because of the presence of a small curved diaeresis on the uropod exopod, because of the shape of cephalothorax and other features. He expressed some doubts as regards a more precise classification especially because of the shape of the cephalothorax, the absence of the branchial incision and the not much visible diaeresis; he did not rule the possibility of a juvenile form of an already known species (Pinna, 1968, p. 111). On the basis of the observations made on the new specimens belonging without any doubt to the same species as the specimen recorded by Pinna, 1968, the confirmed presence of a diaeresis on the uropod and the general characteristics enable me to classify definitely the new species as belonging to the genus *Coleia*. I also exclude the possibility that they are juvenile forms of an already known species, since in the deposit there are several specimens of juvenile forms of the species *C. viallii* and *C. mediterranea*. At first sight, such specimens can be assigned to their respective species, as they already show the main features of the fully developed forms, for instance the shape of the first pair of pereiopods. Furthermore, the individuals of the said species lack the main characteristic typical of the juvenile forms of the species already mentioned, i.e. the eyes, that are much developed if compared with the carapace dimensions; in fact these organs have a normal size with respect to the carapace in the individuals of *C. popeyei* n. sp.

Coleia mediterranea Pinna, 1968

Figs. 11, 12, 13, 14, 15

1968 *Coleia mediterranea* n. sp. - Pinna, p. 123, Figs. 9, 10; Pl. XIII, XIV, XV, XVI.

The species *C. mediterranea* Pinna, 1968, was established on a single specimen not perfectly preserved, which however had such features as to enable the author to recognize it as belonging to the genus *Coleia* Broderip, 1835, and to identify a new species, quite distinct from *C. viallii* Pinna, 1968, coming from the same Osteno deposit. The type-specimen, complete with part and counterpart, is flattened and deformed; the part is kept at the Museo di Storia Naturale di Milano (n. cat. MSNM/i3372) whereas the counterpart belongs to the private collection Pio Mariani in Desio (Milan). Now we have five new specimens available that can be assigned to *C. mediterranea* (n. cat. MSNM/i7656, i7661, i7665, i7690, i7781); they are not in a perfect state of preservation, still they give us the possibility of completing the description made by Pinna, 1968, as well as of confirming the validity of the separation at specific level of this form.

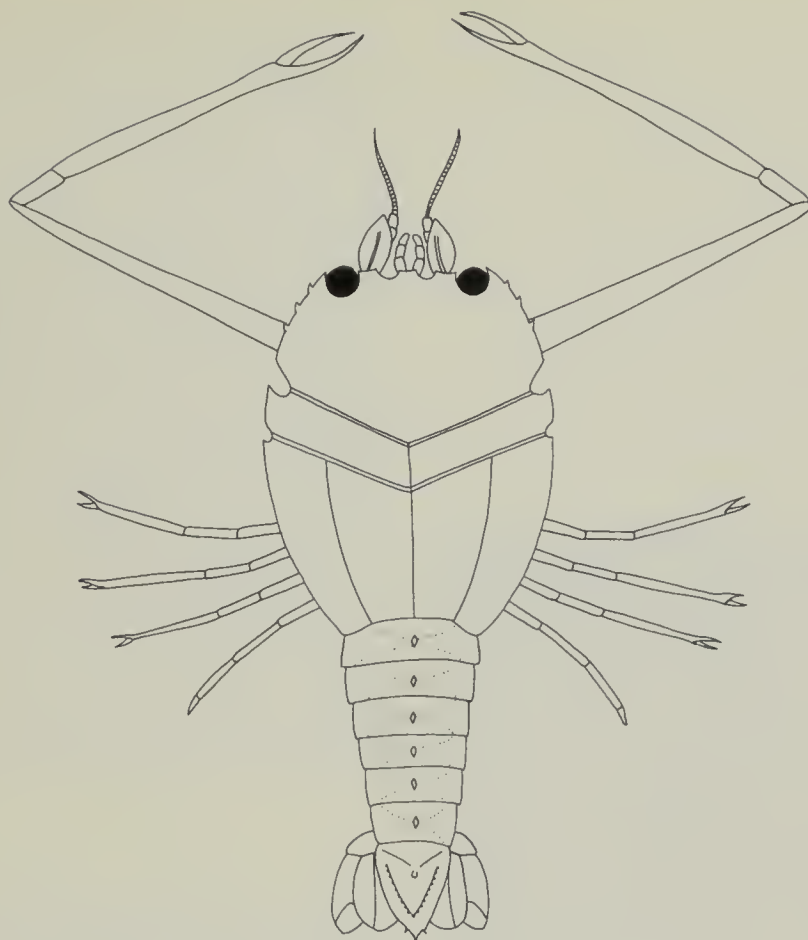


Fig. 11 — *Coleia mediterranea* Pinna, 1968; reconstruction, $\times 0,8$.

Description. The cephalothorax has a subquadrangular shape, with two pairs of very evident lateral incisions (cervical and branchial incisions), bowed lateral margins that slightly converge in proximity of the posterior margin of the cephalothorax, the latter being wide and with rounded extremities. The carapace general morphology of the new specimens coincides with the description of the type-specimen made by Pinna, 1968.

However, from the study of the specimens under examination, it is possible to know further details on groove and ridge patterns. On all new specimens, cervical and branchial grooves are indeed definitely more evident than in the type; they are quite distinct and curvilinear and the cervical groove is deeper than the branchial one (figs. 12, 13, 15). On the carapace dorsal surface there are also a very evident median ridge — as can be seen also in the description of the type specimen — and two well defined lateral ridges (absent in the type) running from the cervical groove to the cephalothorax posterior margin, parallel to the median ridge and only slightly converging anteriorly. The cephalothorax ornamentation consists of clearly visible and proverted spines of varying dimensions; in addition all the carapace looks granulated and covered with tubercles.

The ocular incisions are marked externally by a suprantennal spine and occupy a lateral position on the anterior margin, and contain two large roundish eyes. The cephalic appendages, which are not preserved in the type, can

still be seen partially in the new specimens. The oval, distally pointed scaphocerite bears very evident proverted spines. There are also some fragments of the antennae and antennules with basal articles and part of the flagella; in some cases we can observe a well preserved maxilliped of the shape typical of this genus, with lateral spines (figs. 12, 13, 15).

The abdominal somites feature a median longitudinal ridge on tergites, which surface is also ornamented with tubercles. The triangular telson surface has a tubercular ornamentation, and on the margins there are irregularly scattered spines. The telson apex shows a central denticle accompanied by two lateral denticles (fig. 14). The uropod endopod is roundish; the exopod, which has straighter margins, features a median longitudinal ridge; there is also a much curved diaeresis typical of the family Coleiidae.

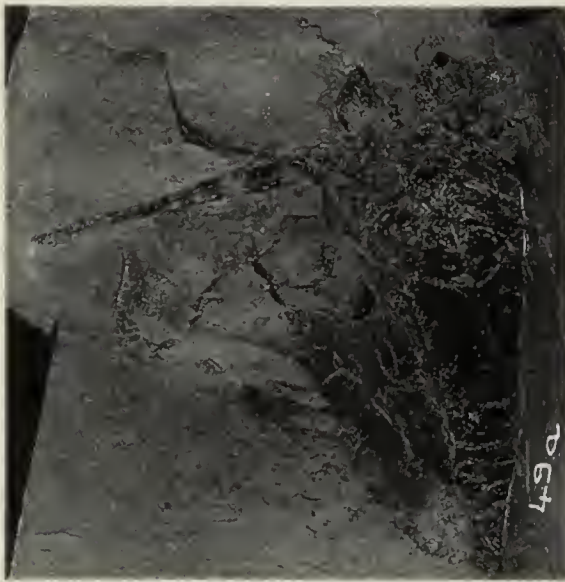


Fig. 12 — *Coleia mediterranea* Pinna, 1968. Es. MSNM/i7656b, counterpart, with reconstruction; $\times 0,8$.

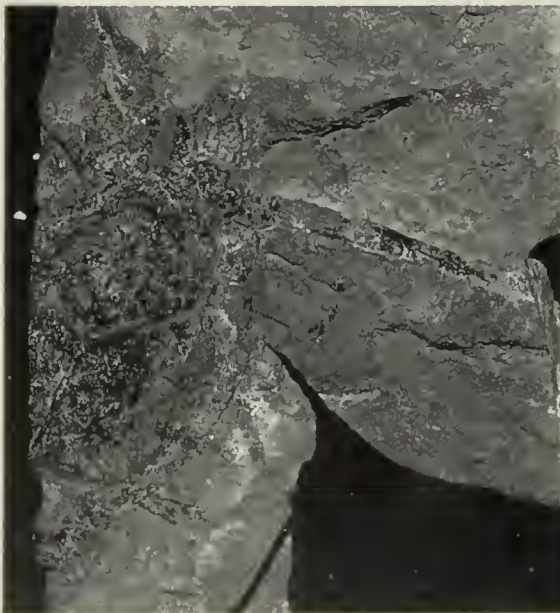


Fig. 13 — *Coleia mediterranea* Pinna, 1968. Es. MSNM/i7656a, part, with reconstruction; $\times 0,8$.

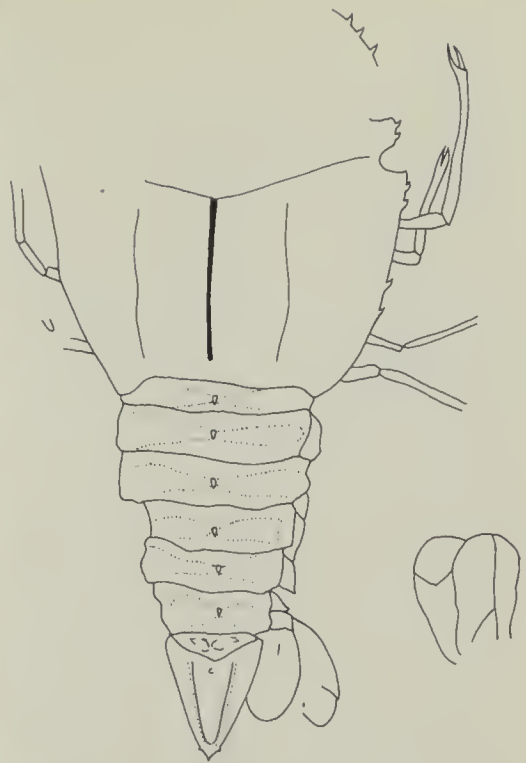
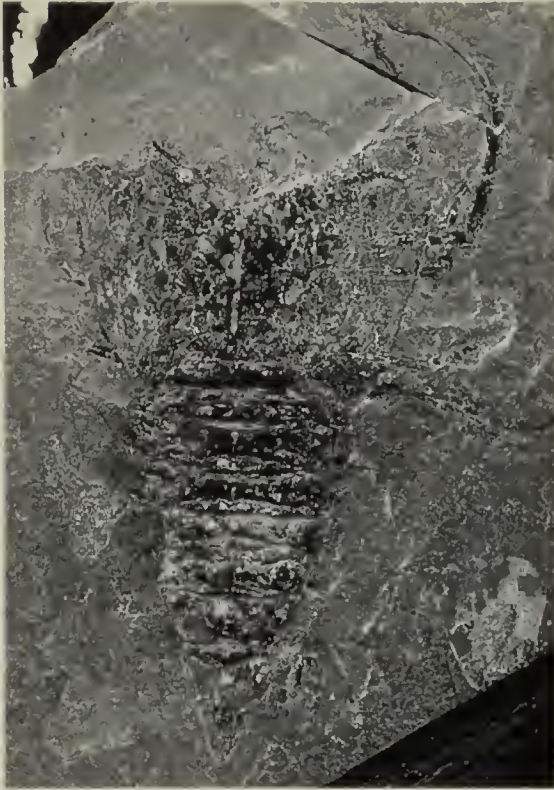


Fig. 14 — *Coleia mediterranea* Pinna, 1968. Es. MSNM/i7665a, part, with reconstruction; $\times 1$.

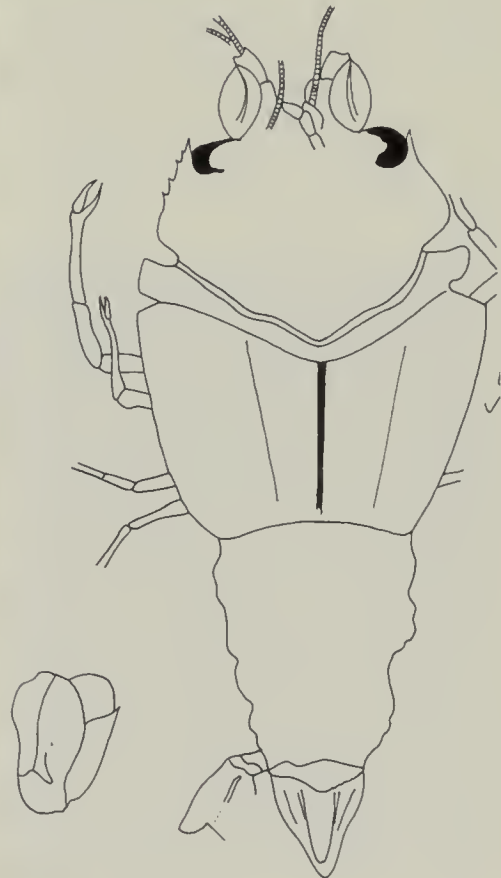
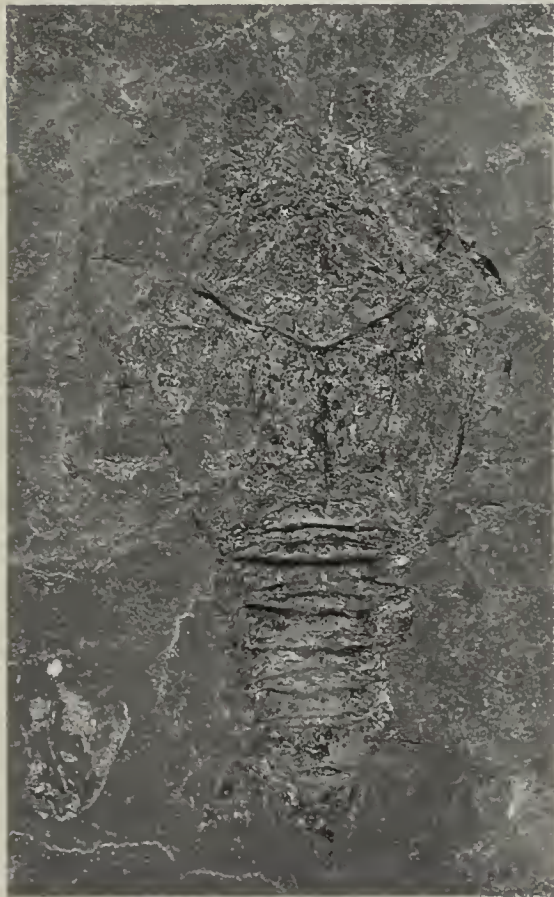


Fig. 15 — *Coleia mediterranea* Pinna, 1968. Es. MSNM/i7665b, counterpart, with reconstruction; $\times 0,9$.

Coleia viallii Pinna, 1968
Figs. 16, 17, 18

1968 *Coleia viallii* n. sp. - Pinna, p. 112, Figs. 5, 6, 7; Pl. III, Fig. 1; Pl. IV, V, VI, VII, VIII, IX, X, XI, XII.

1969 *Coleia viallii* Pinna - Pinna, p. 627, Figs. 1, 2, 3, 4.

Forty-six new specimens are ascribed to this species, that is by far the most numerous in the deposit. These specimens in different state of preservation and of varying size also include some young individuals of small dimensions (see figs. 16, 17, 18). The species *C. viallii* was originally described by Pinna in 1968 on the basis of six differently preserved specimens, that enabled him to reconstruct the carapace, the cephalic appendages and the first pair of pereopods. The reconstruction of the species was later completed by Pinna in a second work in 1969, where he analyzed two new specimens that gave him the possibility to reconstruct all pereopods, abdomen, uropods and telson. Therefore we have sufficient information on general species morphology, and the new specimens show characteristics that differ little or nothing from those recorded by Pinna in his preceding works, but for two specimens.

The specimen MSNM/i 7604 and the specimen MSNM/i 7658 have general morphological features similar to those of *C. viallii*, with the exception of the first pair of pereopods. The specimen MSNM/i 7604 shows a relatively long merus — even if not thin — that becomes thinner distally. On its internal margin there are small proverted spines and a tubercular ornamentation; a weak longitudinal ridge runs parallel to the internal margin. The triangular, elongated carpus features a tubercular ornamentation and a pronounced ridge. The propodus — with the exclusion of the index — is as long as the merus; it is thin and gets even thinner at the distal extremity, in addition it is reinforced by a longitudinal ridge. Dactylus and index are well preserved on the right first pereopod, with the dactylus slightly longer than the index, on

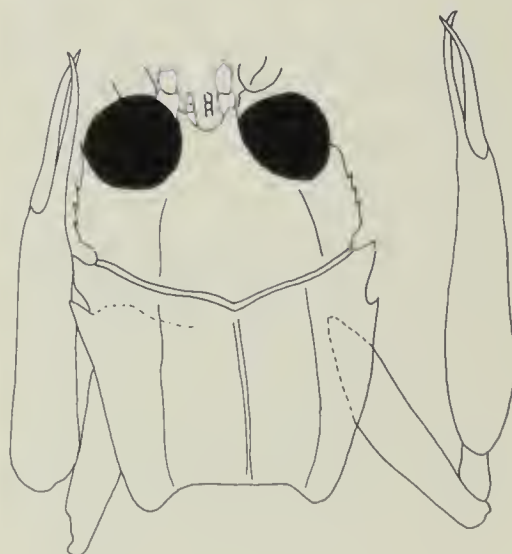


Fig. 16 — *Coleia viallii* Pinna, 1968. Juvenile specimen (n. cat. MSNM/i7709) with reconstruction; $\times 2,6$.

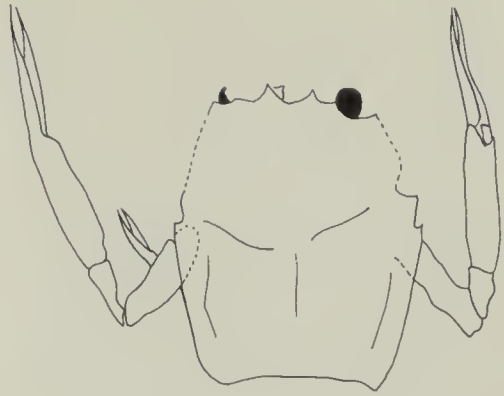


Fig. 17 — *Coleia viallii* Pinna, 1968. Juvenile specimen (n. cat. MSNM/i7708) with reconstruction; $\times 3,2$.

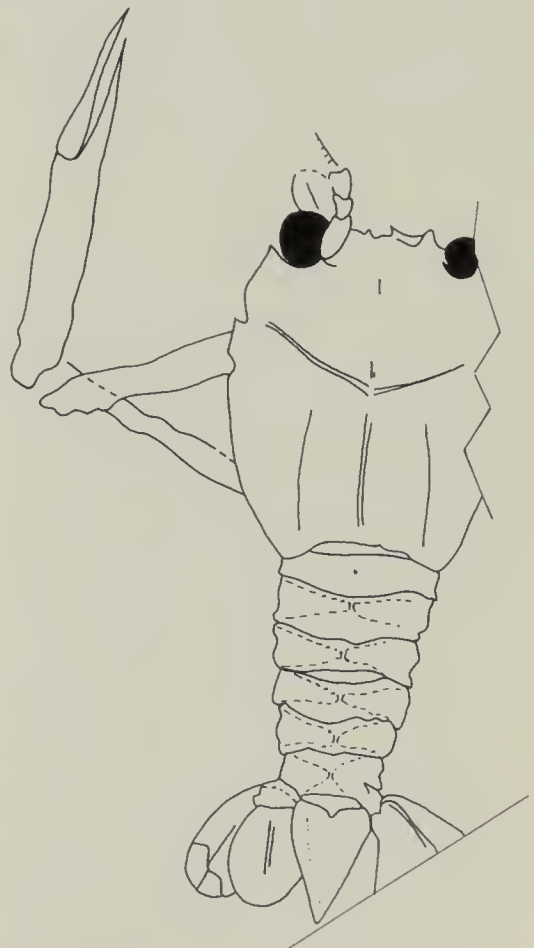


Fig. 18 — *Coleia viallii* Pinna, 1968. Juvenile specimen (n. cat. MSNM/i7704) with reconstruction; $\times 2$.

which it seems to superimpose by bending a little at the distal extremity: however, the reason for this is likely to be the deformation experienced by the animal during fossilization. An analogous morphology of the propodus of the first pair of pereopods is clearly evident in the specimen n. MSNM/i7658, which shows a merus quite similar as regards shape and spine ornamentation. All the other morphological features typical of the species can be identified on the two specimens. Moreover, the morphometric ratios among the various articles of the first pair of pereopods – such as the ratio carpus length/merus length – fall within the range of values typical of this species, ranging between 0.15 and 0.18, whereas for the other species of the deposit this ratio always exceeds 0.22. Therefore I believe that this two specimens can be included in the range of morphological variations of *C. viallii*.

It is interesting to note in the sample the presence of individuals of different sizes, ranging from adult size to very small size. Small specimens can be attributed with certainty to the species since, apart from a less evident carapace sclerotization, they have such characteristics as to make possible an immediate specific attribution; these characteristics are, for instance, the shape of the first pair of pereopods – that is quite similar to that of the larger specimens – and the shape of the carapace, that is to say feature usually best preserved in these specimens. The most striking difference is to be found in the eye size and position as well in the carapace anterior margin. In the smaller individuals eyes are indeed as big as those of adults, and as a consequence we can observe a different form of the anterior margin: eyes are more lateral than in adults and the portion of the carapace lying between the eyes is proportionally longer and narrower than in older individuals; also suprantennal spines are much more posteriorly placed (cf. figs. 16, 17, 18).

Conclusions

As we have seen, the genus *Coleia* is much differentiated at specific level in the Osteno deposit, since so far was identified the presence of five different forms (*C. viallii* Pinna, 1968, *C. mediterranea* Pinna, 1968, *C. pinnai* n. sp., *C. popeyei* n. sp., *C. cf. antiqua*, the latter recorded in Pinna, 1968 and not included with other new specimens in our sample). On the basis of the informations available to me about living eryonoids (for the species *Polycheles typhlops* cf. for instance Santucci, 1932) I can exclude the possibility that, in these forms, differences are due to sexual dimorphism, as long as in the external morphology of the two sexes there are minor differences, at least as regards the major features which can be observed also in fossil specimens. The most evident differences among the Osteno species consist, besides in the size as in the case of *C. popeyei*, in the different form of the first pair of pereopods: from the very long and thin pereopods in *C. pinnai* to the middle long, robust ones with varying carpus lengths in *C. viallii*, *C. mediterranea* and *C. cf. antiqua*, and to an extremely swollen and strong propodus in *C. popeyei*. Such differences show, I believe, the different patterns of adaptation to different trophic niches adopted by the different species of the deposit.

So marked a differentiation at specific level is also typical of other decapod crustaceans found in the deposit (e.g. of the genus *Aeger* Münster, 1839, cf. Garassino and Teruzzi, 1990): the genus *Aeger* is present in the Osteno de-

posit with at least six morphological groups which can be identified at specific level. As regards thylacocephalan crustaceans, of which only one species has been reported so far, i.e. *Ostenocaris cypriformis* Arduini, Pinna and Teruzzi, 1981, they seem instead to be present with at least three different taxa at genus level and even more species, according to recent observations.

Furthermore decapod crustaceans are represented by numerous genera: up to now it has been possible to identify the genera *Aeger* Münster, 1849 (penaeids); *Eryma* Von Meyer, 1840 and *Phlyctisoma* Bell, 1862 (erymid astacids); *Glyphea* von Meyer, 1835, *Mecochirus* Germar, 1827 and *Pseudoglyphea* Opperl, 1861 (glypheid astacids), and of course *Coleia* Broderip, 1835.

In addition to decapod and thylacocephalan crustaceans, two specimens of stomatopods were found in the deposit. Thus the Osteno crustaceans are much differentiated at the level of species and of supraspecific taxa: as far as macroinvertebrates are concerned, they account for definitely more than 60 percent of the species present in the deposit. If one considers the number of individuals contained in the deposit, crustaceans represent the largest majority of individuals, outdistancing greatly all remaining taxa of macroinvertebrates. According to the data inferable from Pinna, 1985, p. 173, crustaceans (thylacocephalan, decapod and stomatopod crustaceans, the latter being absolutely negligible under this aspect, as already seen) account for 92 percent of the whole fauna. The informations given by Pinna, 1985, refer to the fauna found so far in the whole fossiliferous series of Osteno (whole thickness about 6 mm) and are based on the whole Osteno collection of the Museo di Storia Naturale di Milano, that includes collections gathered by many different people, often amateurs. However this information seem to be quite reliable because of the accuracy with which such collections have been made. In the past few years the Milanese museum has carried out directly some excavations, until now only in the upper strata of the series (cf. Pinna, 1985, fig. 1). An analysis of the material as a whole extracted so far confirms the data of all the fauna: crustaceans, in the beds at the top of the fossiliferous series, account for 78 percent of all fossils, vertebrates included.

At present (Coull and Bell, 1983) decapod crustaceans show a considerable specific diversity and a strong numerical superiority towards the invertebrate macrofauna in coral or worm reefs, often associated with stomatopods. The reason for this numerical superiority seems to be the plenty of shelters represented by such biological structures and the remarkable diversification of the available trophic niches. The considerable taxonomic diversity found in such coenosis seems to be caused by the crustaceans capability to exploit the different trophic niches available to them, as well as by physical and environmental factors.

Did the Osteno biotope show any analogies with the modern communities of corals or worms? According to my opinion, all evidence is for reply in the affirmative. The composition of the spongolitic micrite typical of the Moltrasio Limestone Formation of Lombardy (the "Lombardische Kieselkalk" of German speaking authors), that contains the Osteno fossiliferous lens, is very rich in spicules of siliceous sponges, that represent up to 25 percent of the rock. This may indicate that there was an extraordinary flowering of siliceous sponges at least in the less deep areas bordering on the pelagic-neritic basin of the Moltrasio Limestone (Bernoulli, 1964; Kälin and Trümpy, 1977;

Wiedenmayer, 1979). Also the rocks of the Osteno fossiliferous series contain quite a large number of sponges spicules: thus I do not believe it is hasty to venture that an extensive sponge flowering could create many shelters and trophical niches similar to those offered by the coenoses mentioned above.

It is also interesting to point out that, as far as the current demosponge communities are concerned, the main endobionts of sponges (Sarà and Vacelet, 1973) are the crustaceans, along with errant polychaetes and nematodes. Such groups can be found, not only as endobionts, but also as predators together with echinoderms – including brittle stars – and fishes. Even though such speculations have certainly to be further investigated and quantified – and this lies outside the aim of the present work – at a first examination one can see the extraordinary similarity between the said to-day communities and the Osteno fauna. As a results, this fauna could be depicted as a basically epibenthic fauna, based on the presence of siliceous sponge grasslands that were the presupposition for a plentiful and considerably varied fauna of crustaceans, including nematodes, polychaete annelids and ophiurans as accessory elements, with a nectonic fraction represented by cephalopods and fishes, as well as possibly by natant decapods, and a further important benthic fraction accounted for by thylacocephalian necrophagous crustaceans that, due to their morphological and trophic characteristics lived on the soft bottom.

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